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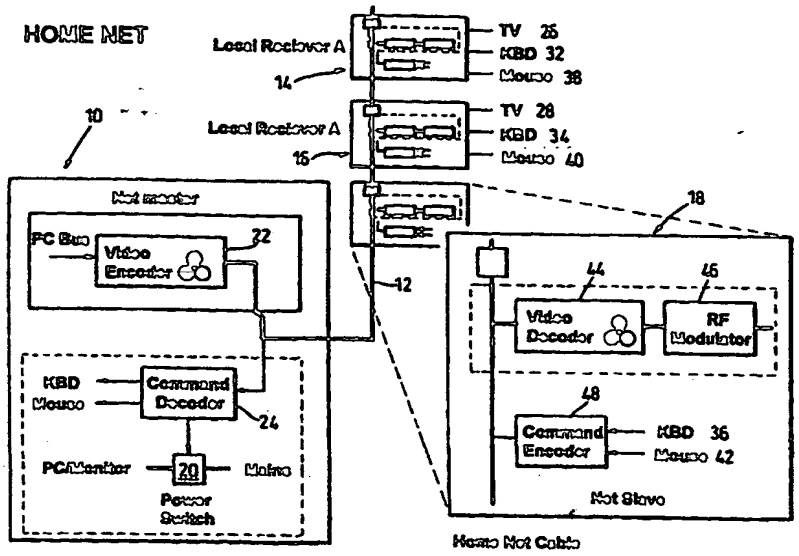

(57) Abstract

A master (10) and slave (18) network apparatus is described which can network a PC to a remote terminal consisting of a television and a user–input device such as a keyboard (36) and mouse (42). The master unit (10) includes RGB filters (52) and A/D converters (54) for capturing and digitising the RGB signals generated by the computer. The signals are processed by ASIC (50), reconverted to RGB analogue data by D/A converters and CLUT (60) and transmitted to the slave unit (18) as a composite video signal. The master unit (10) also includes a data decoder (24) which decodes control signals received from the slave unit (18) and provides them to ASIC (50). The slave unit (18) receives the video signal and RF–modulates it for supply to the aerial socket of the television. A KBD or mouse is associated with the slave, which encodes KBD or mouse data to be transmitted to the master unit (10).

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HOME NETWORKING APPARATUS AND SYSTEMS

The present invention relates to home networking and in particular to apparatus for networking a computer in the home and network systems.

Computers are increasingly found in the home environment and used by adults and children alike. These computers are becoming ever more powerful and consequently more expensive. Often such computers are equipped with multi-media capabilities that utilise sophisticated sound and graphics cards along with CD ROM technology.

Commonly, the need arises for more than one member of the family to use a computer. However, a computer used by one member of the family may be located in a room that is inconvenient for others. In addition, more than one member of the family may require access to a computer at the same time. Often, the cost of equipping each member of the family with his or her own computer is prohibitively expensive and the solution adopted in many office environments of a central fileserver accessed by a number of remote terminals even more so.

It is an object of the present invention to provide a home networking system that is relatively inexpensive as compared with either of the above alternatives. In so doing, the present invention takes advantage of the fact that in recent years, television sets have proliferated dramatically in the home and this application makes a new proposal that these television sets should form the basis of a remote access terminal.

Accordingly, the present invention provides a network apparatus for networking a computer to a remote television or monitor comprising:

means for capturing the display information generated by the computer and transmitting it to the remote television or monitor; and

means for switching between local and remote user-input devices.

The present invention also provides a master and slave network apparatus for networking a computer to a remote television in which:

the master unit comprises means for capturing the display information generated by the computer and transmitting it to the slave unit as a video signal; and means for providing to the computer control signals received from the slave unit; and

the slave unit comprises means for receiving the said video signal and driving the remote television in response; a user-input device; and means for transmitting control signals to the master unit in response to operation of the user-input device.

It will therefore be appreciated that all that is required to convert a computer to an inexpensive network according to the present invention is a television or monitor connection and a simple input-device switching means on the one hand or a master unit and a slave unit, both of which are relatively inexpensive as they do not require complex circuitry or large memories, on the other hand, together with and a user-input device such as a keyboard, a mouse, a trackball or a joystick.

Preferably, for games-playing or multi-media applications, the said video signal includes audio information. For example, the said video signal may be a composite video signal. In this case, the slave unit may apply the composite video signal directly to the television, either RF-modulated through the aerial socket, or bypassing the RF circuitry altogether, e.g. through a SCART socket.

It is recognised that the resolution of a domestic television set leaves something to be desired. In some applications, such as high resolution graphics processing,

the loss of resolution is unacceptable. To deal with this problem, the apparatus preferably includes means for driving the remote television to display only a portion of the display area. As only a portion of the display area is displayed, a magnified image is presented.

Preferably, the portion of the image that is displayed is selected automatically according to where the image is changing. Thus, the network apparatus preferably includes means for panning across and/or zooming into the display area automatically, so as to display a portion of the display area in which the image is changing.

One way of achieving this is to calculate a checksum for a plurality of subdivisions of the display area and to display one or more such subdivisions in which the checksum changes from frame to frame. For example, if the magnification is four (two x two), the preferred number of subdivisions is sixteen (four x four) and the portion of the display area displayed will be centred on whichever subdivision or subdivisions undergo a change in checksum value from one frame to the next.

Preferably, processing means are provided for reducing pixel edge effects of the enlarged image.

To allow multiple concurrent access, the apparatus is preferably adapted to network the computer to two or more remote televisions concurrently and in which a plurality of such slave units are provided.

The present invention also extends to a network system comprising a computer and master and slave apparatus according to the invention for networking the computer to two or more remote televisions concurrently.

In such a system, it is clearly desirable that the two or more users are able to work on-screen independently. One way of achieving this is for the computer to be configured,

in software of hardware, to provide a display information signal including separable display data for different users. For example, the display information signal may represent a display area divided into areas allocated to different users. Alternatively, the display information signal may include frames of display data for different users interleaved with one another. In such a case, it is preferable that the slave unit be adapted to drive its corresponding television only with frames of data allocated to it.

As an alternative to the above, the computer may be configured, in software or in hardware, to provide more than one separate display information signals for different users and the master unit adapted to combine the separate signals into a single video signal. Such a single video signal may represent a display area divided into areas allocated to different users, or may include frames of display data for different users interleaved with one another. Again, in the latter case, the slave unit is preferably adapted to drive its corresponding television only with frames of data allocated to it.

As stated previously, the user-input device may include a pointing device. In single user modes or interleaved image modes, the pointer or cursor may be inserted into the display area by the computer. However in multi-user split screen mode (and if desired in the other modes) the pointer or cursor may be inserted into the display area by the slave unit. In split-screen mode, this prevents any one user from seeing the pointer or cursor of the other user or users.

The interconnections between master and slaves may be by wireless or by wire connections or by optical fibres, but it is preferred that they be by network wires.

For reasons that will be apparent, the video signal may include control data and the slave unit or units include

means for extracting the control data from the video signal.

The present invention will now be described by way of example with reference to the accompanying drawings in which:

FIG. 1 is a schematic of a network system according to the invention;

FIG. 2 is a block diagram of a master unit; and

FIG. 3 is a block diagram of a slave unit.

As can be seen from FIG. 1, the network system includes a master unit 10, connected via network wires 12 to three, slave units 14, 16, 18. The master unit 10 includes a power switch 20, by which power is supplied from the mains to a PC and monitor. For reasons that will become apparent, the master unit has its own power switch (not shown). The master unit 10 includes a video encoder 22, which receives RGB data and outputs composite video data to the network connections 12. Also included is a command decoder 24, which extracts command data such as keyboard and mouse operation data from the network connections 12, supplied by the slave units 14, 16, 18. The command decoder 24 provides KBD and mouse signals to the PC, e.g. by taking control of the KBD and mouse ports. In addition, the command decoder 24 has control of the power switch 20 to enable the PC or PC and monitor to be powered up remotely.

Each of the slave units 14, 16, 18 interfaces to a television 26, 28, a keyboard 32, 34, 36 and a mouse 38, 40, 42. A video decoder 44 in each slave unit receives composite video from the network connections 12. In the embodiment illustrated, the video is RF-modulated by modulator 46 for supply to the aerial socket of the television. If the supply is direct to a SCART socket, thus bypassing the RF stage, the modulator 46 will not be required. A command encoder 48 encodes inputs received from the user-input devices which in this case include KBD

36 and mouse 42 for transmission to the master unit 10, and subsequent decoding by the command decoder 24 and supply to the PC.

The master unit 10 is illustrated in more detail in FIG. 2. ASIC 50 is connected to the system ISA bus. RGB data passes through filters 52, A/D converters 54 and is provided to ASIC 50. KBD and mouse information (KBD in, Mouse in) is received from the local keyboard and pointing device. Additional KBD and mouse information is decoded from the network connections by data decoder 61. As required, the local or decoded KBD and mouse data is output to the appropriate PC ports (KBD out, Mouse out). In multi-user interleaved screen modes, the pointer or cursor is inserted in to the video display data by the ASIC. Two lots of 256k x 16 memories 56, 58 are utilised by ASIC 50.

Digitised RGB data is received from A/D converters 54 by ASIC 50 and stored in memories 56, 58 for processing. Once any processing is complete, digitised RGB data is output by ASIC 50 to colour look up table (CLUT) and D/A converters 60, followed by PAL/NTSC encoder 62 to be encoded to the appropriate standard and is output as composite video. Audio data (Audio in) is encoded with the composite video although shown separately in FIG. 2.

ASIC may perform a number of image processing operations, such as the insertion of a pointer or cursor in the display data. In the case where automatic pan/zoom operations are required, the processing for these operations is performed by ASIC 50. An example of the pan/zoom processing operations will now be described. Assuming that the degree of magnification required is four (two x two), ASIC 50 subdivides the digitised image data into sixteen subdivisions (four x four). For each subdivision, ASIC 50 calculates a checksum (which expression shall be understood to refer to any appropriate sum or parity calculation), in this case by adding the digitised data for each pixel within the relevant subdivision into a checksum figure.

The sixteen checksums are stored for future reference.

When the next frame of RGB data is received, ASIC 50 performs the same checksum calculation for the sixteen image subdivisions and compares the values so obtained with the stored values. Usually, just one checksum value will differ from the previously stored value, indicating that the picture has changed in the corresponding subdivision. In that case, the magnified display data provided to CLUT and D/A converter 60 is centred upon that subdivision. In some circumstances, for example where a character entered into a word processor overlaps the margin between subdivisions, two checksums may be found to be different. The magnified image data will then include the whole of those two subdivisions, centred vertically or horizontally as the case may be. In even rarer circumstances, a character may overlap four contiguous subdivisions in which case all four such subdivisions are displayed.

In the case where the whole image changes, all checksums change and no change is made to the portion of the image displayed. This may occur when, for example, a word processor screen scrolls by one line or is re-formatted. ASIC includes interpolation/decimation circuitry for reducing pixel edge effects, as will be well understood.

The slave unit 18 is shown in more detail in FIG. 3. Video and audio data are again shown separately, but may in fact be combined in the composite video signal. Audio and video data are separated from the composite signal and RF modulated for supply to the aerial socket of the television. Control data is extracted from the composite video signal by data detector 64. Such command data may, where a multi-access interleaved display mode is adopted, indicate to which user the current frame data is allocated. ASIC 66 controls audio switch 68 and receives KBD and Mouse data (KBD in, Mouse in). This data is supplied to data encoder 70 and once encoded is transmitted to the master unit 10 via network connections 12.

Although not shown in FIG. 3, where a split screen multi-user mode is employed, ASIC 66 inserts pointer or cursor information into the video signal.

It will be understood that there are a number of raster lines at the beginning and end of each frame that are not displayed on the television and that the control data transmitted from the master to the slaves and vice versa is transmitted in the video signal at the point corresponding to these unused raster lines.

Because the PC/monitor power switch 20 is under the control of the master unit, the PC may be powered up remotely by a control signal from the slave unit to the master. In addition, depending upon the source of the power-up control signal, the PC may be powered up by the master unit in different modes. This may allow different O/S configurations or prevent accidental access by one user to another's files. Furthermore, the master may prevent one user powering down the PC whilst any other user remains connected.

CLAIMS

1. A network apparatus for networking a computer to a remote television or monitor comprising:

means for capturing the display information generated by the computer and transmitting it to the remote television or monitor; and

means for switching between local and remote user-input devices.

2. A master and slave network apparatus for networking a computer to a remote television or monitor in which:

the master unit comprises means for capturing the display information generated by the computer and transmitting it to the slave unit as a video signal; and

the slave unit comprises means for receiving the said video signal and driving the remote television or monitor in response; a user-input device; and means for transmitting control signals to the master unit in response to operation of the user-input device.

3. A network apparatus according to claim 1 or claim 2 in which the said video signal includes audio information.

4. A network apparatus according to any preceding claim in which the video signal is a composite video signal.

5. A network apparatus according to any preceding claim including means for driving the remote television or monitor to display only a portion of the display area.

6. A network apparatus according to claim 5 including means for panning across and/or zooming into the display area automatically, so as to display a portion of the display area in which the image is changing.

7. A network apparatus according to claim 6 including means for calculating a checksum for a plurality of subdivisions of the display area and for displaying one or

more such subdivisions in which the checksum changes from frame to frame.

8. A network apparatus according to any one of claims 5-7 including processing means for reducing edge effects.

9. A network apparatus according to claim 2 adapted to network the computer to two or more remote televisions concurrently and in which a plurality of such slave units are provided.

10. A network system comprising a computer and master and slave apparatus according to claim 9 for networking the computer to two or more remote televisions concurrently.

11. A network system according to claim 10 in which the computer is adapted to provide a display information signal including separable display data for different users.

12. A network system according to claim 11 in which the display information signal represents a display area divided into areas allocated to different users.

13. A network system according to claim 11 in which the display information signal includes frames of display data for different users interleaved with one another.

14. A network system according to claim 13 in which the slave unit is adapted to drive its corresponding television only with frames of data allocated to it.

15. A network system according to claim 10 in which the computer is adapted to provide one or more separate display information signals for different users and the master unit is adapted to combine the separate signals into a single video-signal.

16. A network system according to claim 15 in which the single video signal represents a display area divided into

areas allocated to different users.

17. A network system according to claim 15 in which the single video signal includes frames of display data for different users interleaved with one another.

18. A network system according to claim 17 in which the slave unit is adapted to drive its corresponding television only with frames of data allocated to it.

19. A network system according to any one of claims 10-18 in which the user-input device includes a pointing device.

20. A network system according to claim 19 in which the pointer or cursor is inserted into the display area by the master unit or the slave unit.

21. A network apparatus or system according to any preceding claim in which the components are interconnected by optical fibres.

22. A network apparatus or system according to any one of claims 1-20 in which the components are interconnected by wires.

23. A network apparatus according to claim 2 or a system according to any one of claims 10-20 in which the video signal includes control data and the slave unit or units include means for extracting the control data from the video signal.

24. A network system substantially as described herein with reference to the accompanying drawings.

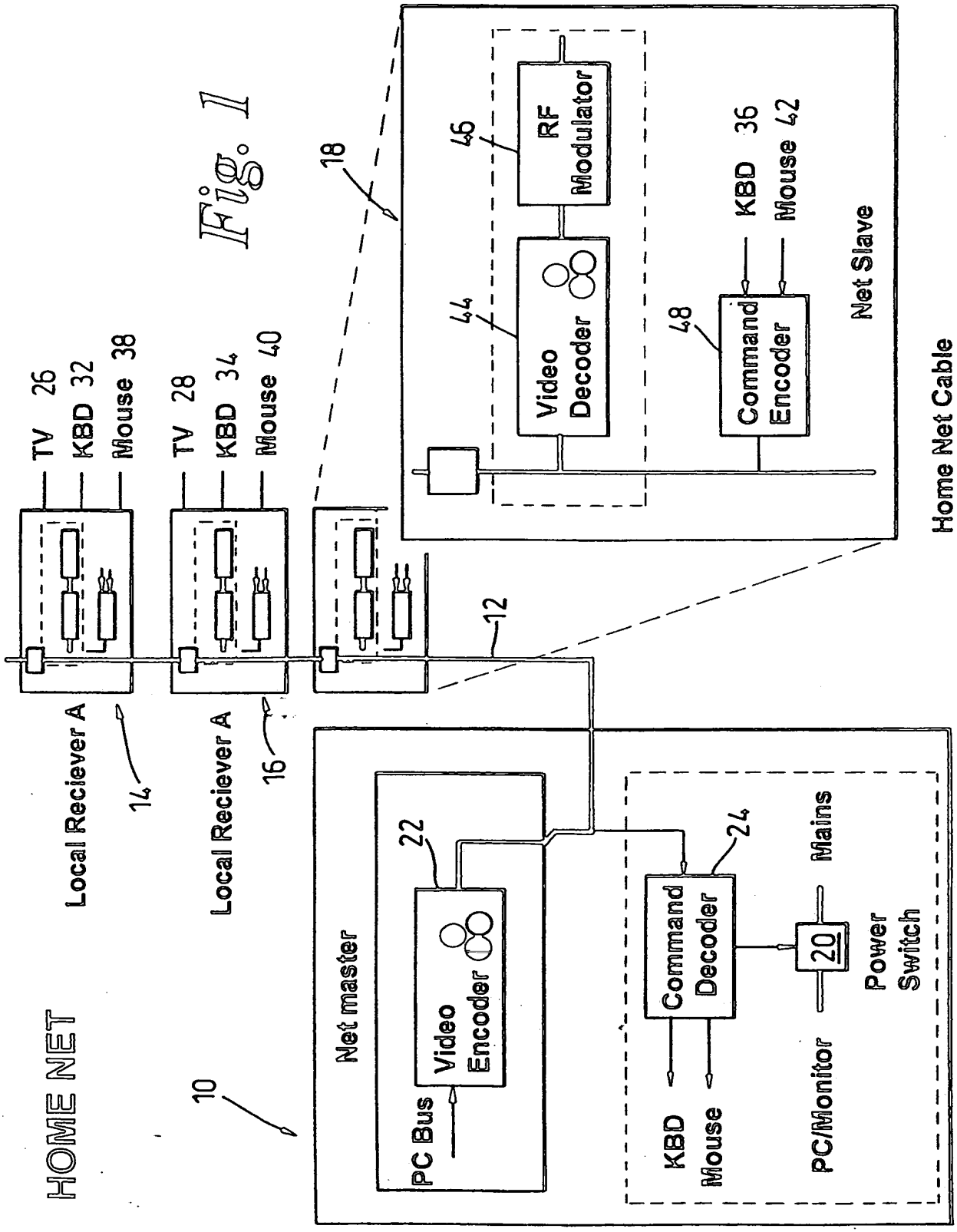

Fig. 1

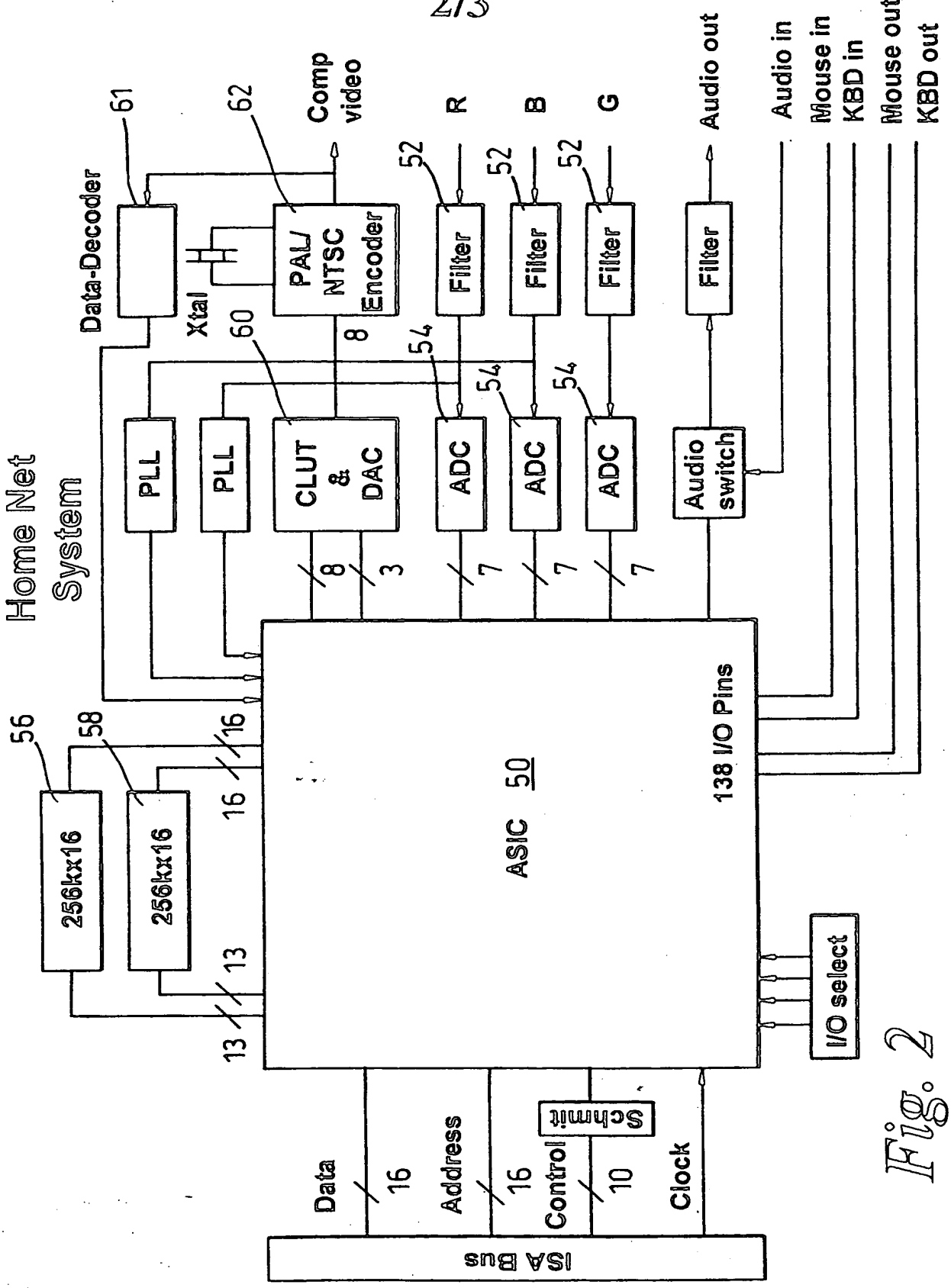

Fig. 2

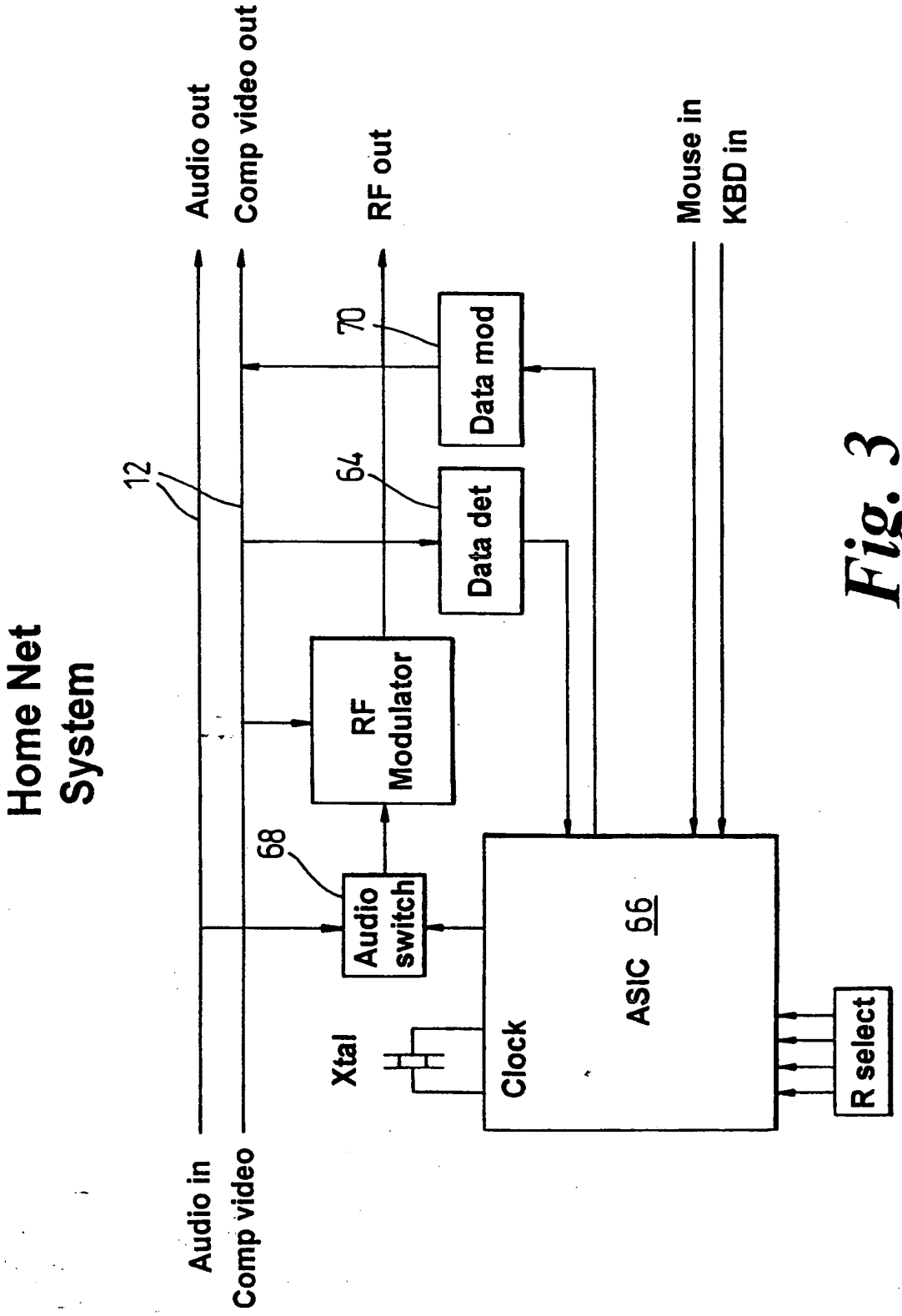

Fig. 3

INTERNATIONAL SEARCH REPORT

In .ational Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 G06F3/00 H04N5/445 H04N7/10

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04N G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y		21
A		24

X	US 3 569 617 A (ALLEN MURRAY W ET AL) 9 March 1971 see figure 1 see column 1, line 24 - line 53 see column 2, line 1 - line 42	2,4, 9-11,19, 22,23
Y		3,5,6, 12-18
A		20,24

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
21 August 1998	28/08/1998

Name and mailing address of the ISA	Authorized officer
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

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